valued. Both of these methods are defective in that they fail to recognize the importance of non-luminous rays in plant processes, a fact that has been thoroughly established by BROWN and ESCOMBE.—BARRINGTON MOORE.

Plant formations of Caithness.—A report by CRAMPTON[15] on the ecology of some of the northern parts of Scotland relates the development and succession of the various plant associations to the physiography of the region to an extent quite surpassing previous discussions of the vegetation of the British Isles. There is also a dynamic point of view maintained throughout and particularly emphasized in the study of the progressive and retrogressive phases of the moorland formation. The author not only recognizes the stable and successional formations of the topographic cycles, but also the regional successions as exemplified in the remains of tundra, forest, and moorland vegetation found in the peat mosses. This full appreciation of the dynamics of plant formations marks the study as one of first rank, and indicates a decided advance for British ecologists.

The extinct formations recognized are the pine forests, the tundra, and the arctic peat mosses, all related to the advancing and receding ice sheets of the geological period of glaciation, while the existing formations include the alpine and subalpine, the moorland, and, in less prominent development, those of the drainage system and coastal belt. From the exposure and altitude of most of the area studied, associations of sphagnum and other mosses and of the heather are the most abundant types of vegetation. Among the problems discussed, two may be cited as of special interest and as indicating to some extent the scope of the work. The one deals with the relationship of the *Calluna* mat of the alpine plateaux to the destructive winds, resulting in the development of a series of ridges and troughs of vegetation; the other is a part of the ecological relations of the moorland to the drainage system, and demonstrates the present decline of the peat bogs with the advance of river erosion. The reaction of sphagnum growth upon drainage and erosion is also carefully considered, as well as the competition between *Sphagnum* and *Calluna*, the two most conspicuous members of the moorland vegetation.—GEO. D. FULLER.

Fertilization in Taraxacum.—RAUNKIÄR'S castration experiments on several forms of *Taraxacum*, as well as MURBECK and JUEL'S cytological investigations, have proved that parthenogenetic or apogamous development of the embryo prevails in this genus. DAHLSTEDT later published the view that in two or three species of *Taraxacum* grown in a Belgium garden pollination seemed necessary to seed formation. ROSENBERG has described the normal occurrence of the reduction division in the nucleus of the embryo sac mother cell of *Taraxacum*, and HANDEL-MAZZETTI has announced the appearance of

[15] CRAMPTON, C. B., The vegetation of Caithness considered in relation to the geology. pp. 132. Edinburgh: Published under the auspices of the Committee for the survey and study of British vegetation. 1911.

hybrids among the species of the genus. From this statement it is evident that normal fertilization in certain species of *Taraxacum* might be expected.

IKENO[16] has been investigating this situation, and has published recently some of his results. Two species of *Taraxacum* grow in Tokyo, *T. platycarpum* Dahlst. and *T. albidum* Dahlst. During 1908 and 1909, TANAKA, after RAUNKIÄR's method, made castration experiments with the two species and found that *T. albidum* only formed seeds parthenogenetically. In the spring of 1910, IKENO found growing in a field three different varieties of *T. platycarpum* which might perhaps be elementary species in the DEVRIES' sense. With these forms, he performed the following experiments. When the heads were enveloped with sacs, no seeds were matured; which means that in this case there occurred neither self-fertilization, parthenogenesis, nor effective pollination among the flowers in the same head. A similar experiment was tried with *T. albidum*, and the heads with and without sacs produced seeds. Then he took another variety of *Taraxacum* and put sacs around the heads, which later withered entirely. Then he brushed the surface of the heads of the variety before applying sacs, in order to carry the pollen of one flower to another of the same head, and only 5 out of 80 flowers in a head matured perfect seeds; but when the pollen of another head was applied, the majority of the flowers matured seeds. From these experiments he concludes that in *T. platycarpum* there occur no cases of parthenogenesis, while in the other forms of *Taraxacum* cases of parthenogenesis and normal fertilization both occur.—S. YAMANOUCHI.

Inflorescence and ovules of Gnetum.—Mrs. THODAY (SYKES)[17] has investigated the ovulate strobilus and ovules of *Gnetum africanum*, from material obtained by PEARSON during the Percy Sladen Memorial Expedition in southwest Africa. The vascular situation presents some facts of unusual interest. In the nodes of the ovulate strobilus three concentric rings of bundles occur, the middle one being oriented inversely in relation to the other two, and concentric bundles occurring frequently in the two outer rings. The vascular connections of a single ovulate "flower" in *G. africanum* are said to bear "a remarkably close resemblance to the method of supply to the axillary inflorescence in *Bennettites*." A ring of bundles enters the base of the ovule, and finally breaks into three sets, which traverse the three "coverings" of the ovule, the innermost set traversing the inner integument to and sometimes beyond its separation from the nucellus. A well developed pollen chamber is present in the young ovule, and later the apex of the nucellus hardens and forms a pointed cap.

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[16] IKENO, S., Sind alle Arten der Gattung *Taraxacum* parthenogenetisch? Ber. Deutsch. Bot. Gesells. **28**:394–397. 1911.

[17] THODAY (SYKES), MARY G., The female inflorescence and ovules of *Gnetum africanum*, with notes on *Gnetum scandens*. Ann. Botany **25**:1101–1135. *pls. 86, 87. figs. 16.* 1911.